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ABSTRACT

In 1991, Ohio received funding from the National Science Foundation (NSF) for a Statewide Systemic Initiative called Discovery to reform science and mathematics education. Funding since that year has included a grant to identify barriers to science and mathematics education reform, particularly barriers such as community and school resources, teaching practices, and student attitudes, that may result in achievement differences among groups of students. State funding to improve the college education of all teachers of science and mathematics was also received. In 1995, four years into Ohio's systemic reform, a study to describe the landscape of science and mathematics education was begun. The findings, published annually in the Pocket Panorama, describe a changing landscape along with documenting accomplishments and continuing challenges. Because proficiency test scores are not accessible for individual students, Discovery developed valid and reliable tests to assess how the reform is meeting the challenges. This edition of the Panorama presents information on the location of reform programs, the number of participants (schools, principals, teachers, and students), and profiles how the student sample compares with all Ohio students. Teacher and student responses have been contrasted with the amount of professional development teachers have had as part of the reform. Educational aids in the home, professional development providers, and changes in classroom practices are also discussed. (PVD)

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1

Bridging the Gap: Equity in Systemic Reform

A Pocket Panorama of the Landscape Study, 1997

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2

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Ohio's Systemic Initiative

Disco ery

Bridging the Gap:

Equity in Systemic Reform

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1998, Jane Butler Kahle, Steven R. Rogg, Miami University

3

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Systemic Reform of Mathematics and Science Education

In 1991, Ohio was one of the first ten states to receive funding from the National Science Foundation (NSF) for a Statewide Systemic Initiative (*Discovery*) to reform science and mathematics education. Guided by the Ohio Board of Regents and the Ohio Department of Education and supported by the General Assembly, *Discovery* served as a catalyst to enhance learning of mathematics and science across Ohio, particularly in middle schools; to alter teaching methods; and to change public opinion.

In 1993, Ohio's three eligible cities (Cincinnati, Cleveland, and Columbus) received NSF funds for Urban Systemic Initiatives. When the Appalachian Rural Systemic Initiative was funded by NSF in 1994, the five eligible Ohio counties became part of it. The systemic initiatives collaborated with many institutions and agencies to change the landscape of science and mathematics education in Ohio. That landscape has been described in the *Pocket Panoramas* of 1995 and 1996.

In 1996, a three-year NSF grant, *Bridging the Gap: Equity in Systemic Reform*, was awarded to focus on identifying barriers to science and mathematics education reform, particularly barriers (community and school resources, teaching practices, student attitudes) that may result in achievement differences among groups of students.

In 1997, Ohio's General Assembly funded Ohio's Systemic Initiative–*Discovery* for two years with mandates to expand to elementary and high schools, to improve the college education of all teachers of science and mathematics, and to continue studying and reporting on the effectiveness of Ohio's reforms. *Bridging the Gap* and *OSI-Discovery* bring you the third *Pocket Panorama* that describes continuing changes in teaching practices, in student attitudes, and in student learning of mathematics and science.

The Story of Reform: The Landscape Study

In 1995, four years into Ohio's systemic reform, a study to describe the landscape of science and mathematics education was begun. The findings, published annually in the *Pocket Panorama*, describe a changing landscape and document accomplishments as well as continuing challenges. One challenge is narrowing achievement gaps among groups of students while improving learning by all students. Because proficiency test scores are not accessible for individual students, *Discovery* developed valid and reliable tests to assess how the reform is meeting this challenge.

Past editions of the *Pocket Panorama* described the design of the study, the numbers of principals, teachers, and students involved in it, and how the profile of its random sample of schools matched the profile of all Ohio schools. This year some changes have been made; for instance, the profile of the student sample is compared to that of all Ohio students. Ohio's reform of science and mathematics education involves a mix of systemic, state, and local initiatives. Therefore, this year teacher and student responses have been contrasted by the amount of professional development teachers have had as part of the reform. Also new is information about who provides professional development for practicing teachers and the efforts to improve science and mathematics education for prospective teachers through Project *SUSTAIN*.

Our ability to paint the landscape accurately and with increasing detail continues to be dependent upon the good will and cooperation of the many principals, teachers, and students who have allowed us to share the excitement and challenge of teaching and learning high quality mathematics and science. We thank each of them for their continued support!

Where is the Reform in Ohio?

Although *OSI-Discovery* teachers (Discovery and Cascade programs) are found across Ohio, they are clustered in areas of great need—its urban centers (left). State, urban, and rural systemic initiatives provide an impetus for reform (right).

Figure 1a: *OSI-Discovery* Teachers in Ohio

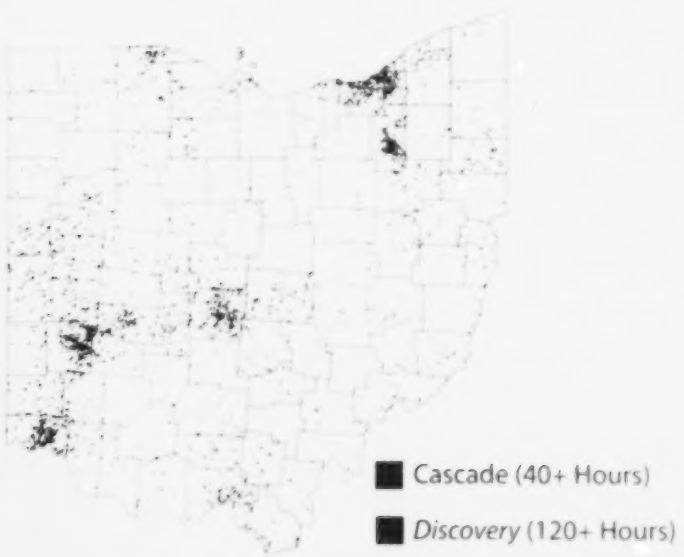


Figure 1b: Cities and Counties with Systemic Initiatives

Who Participates in the Landscape Study?

Annually, principals and teachers in over 100 randomly selected schools across Ohio respond to questionnaires. Science and mathematics classes are observed and student learning is assessed in rural and urban schools that serve many students living in poverty.

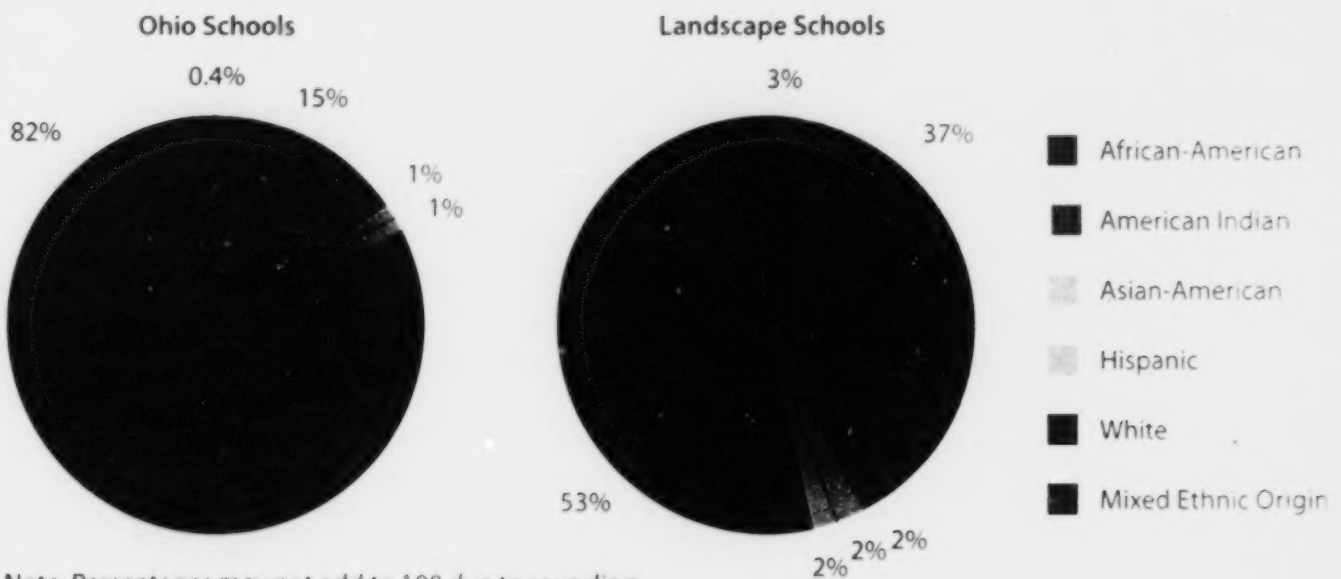
Figure 2: Landscape Study Participants

	1995	1996	1997
Schools	108	111	144
Principals	108	92	140
Parents	120	250	228
Teachers	1,024	834	1,350
Students	1,428	4,015	2,574

Which Students Are Involved in the Landscape Study?

Student learning is assessed in schools that enroll large numbers of economically disadvantaged students. Landscape's sample contains high proportions of minority students.

Figure 3: Comparison of Student Demographics at Ohio and Landscape Schools

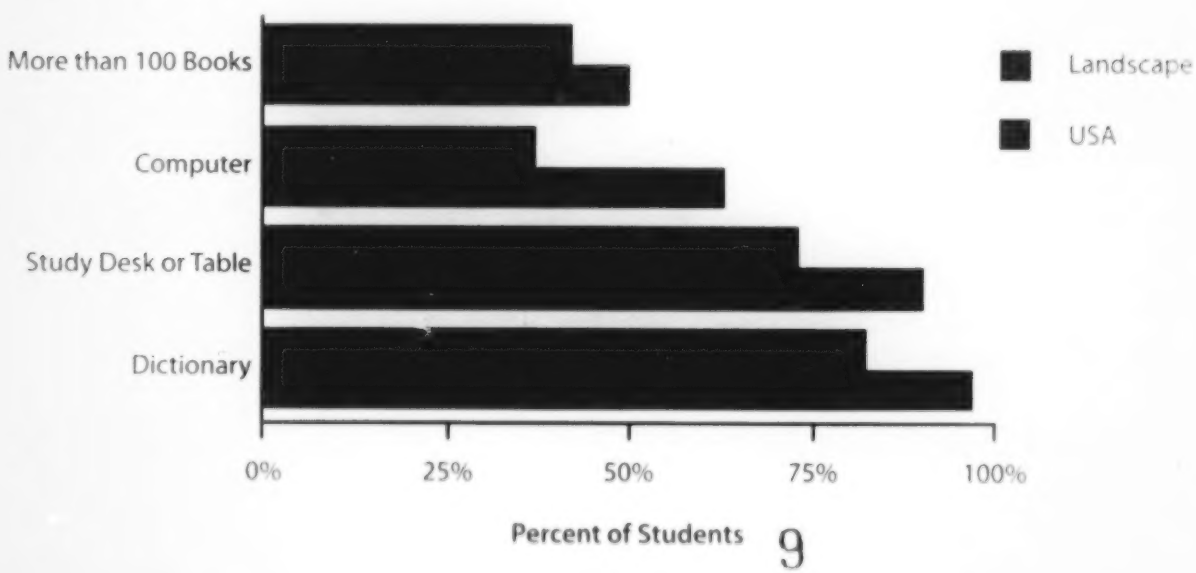


Note: Percentages may not add to 100 due to rounding.

How is Need Evident Among Landscape Students?

Compared to national averages, Landscape students have less access to basic educational resources in their homes.

Figure 4. Percent of Students Reporting Educational Aids in their Homes



Note: The Third International Mathematics and Science Study (TIMSS) is the source of the national data

Who Provides Professional Development for Ohio's Teachers?

Teachers in the random sample participate in professional development activities provided by many groups and agencies. Analyses suggest that sustained activities, focused on increasing subject knowledge and teaching skills, change classroom practices (shown on the following pages).

Figure 5a: Average Time Spent Learning by Type of Provider in 1997

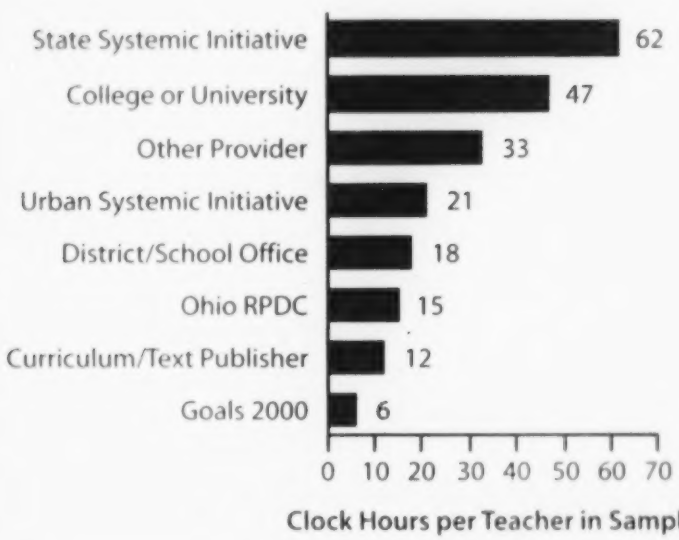
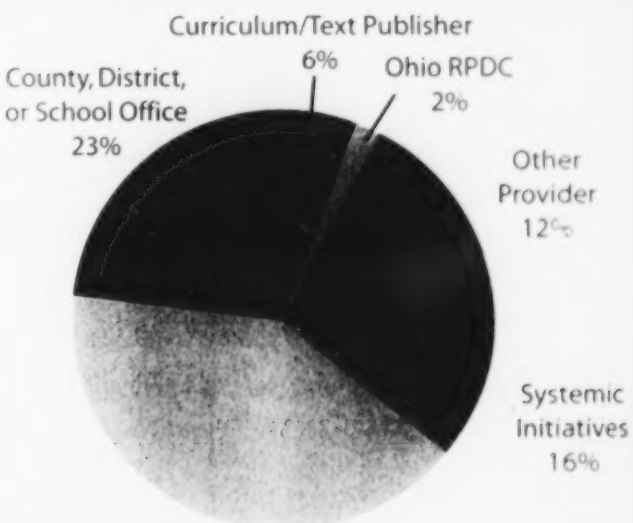


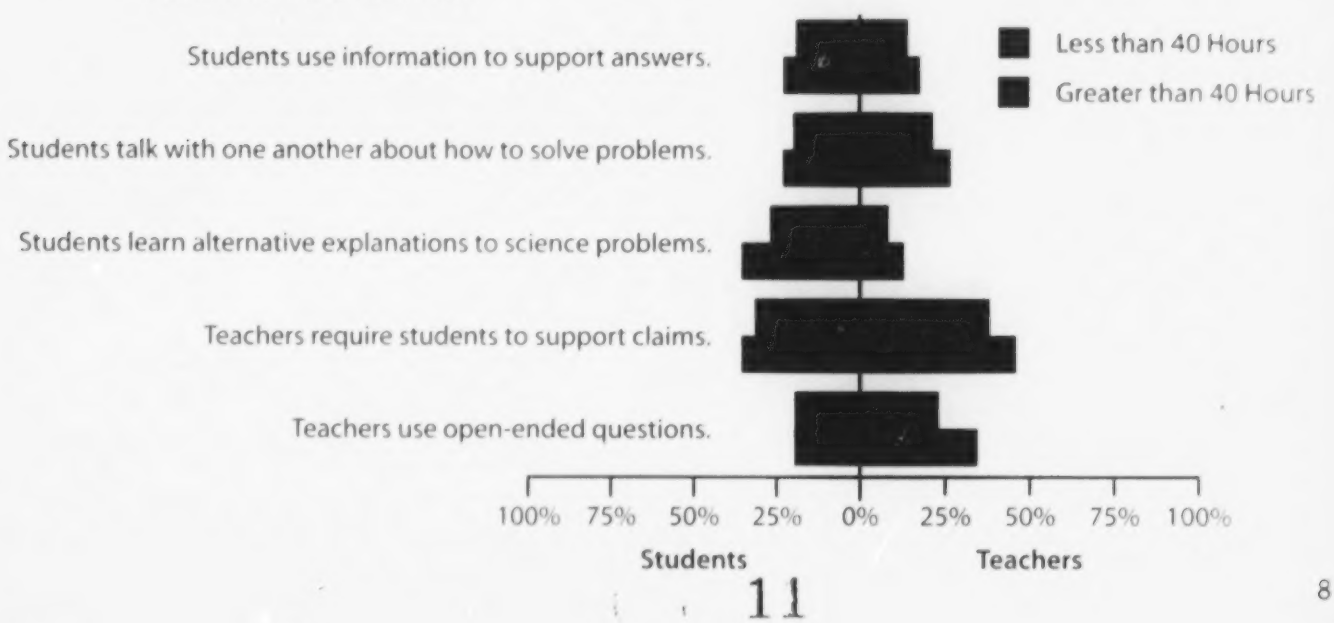
Figure 5b: Percent of Total Teacher Professional Development Provided in 1997



How are Classroom Practices Changing?

Comparison of responses of teachers, who have 40 or more hours of professional development in the last year with those of teachers with less than 40 hours, describes different practices. In both groups, teacher responses are supported by those of their students.

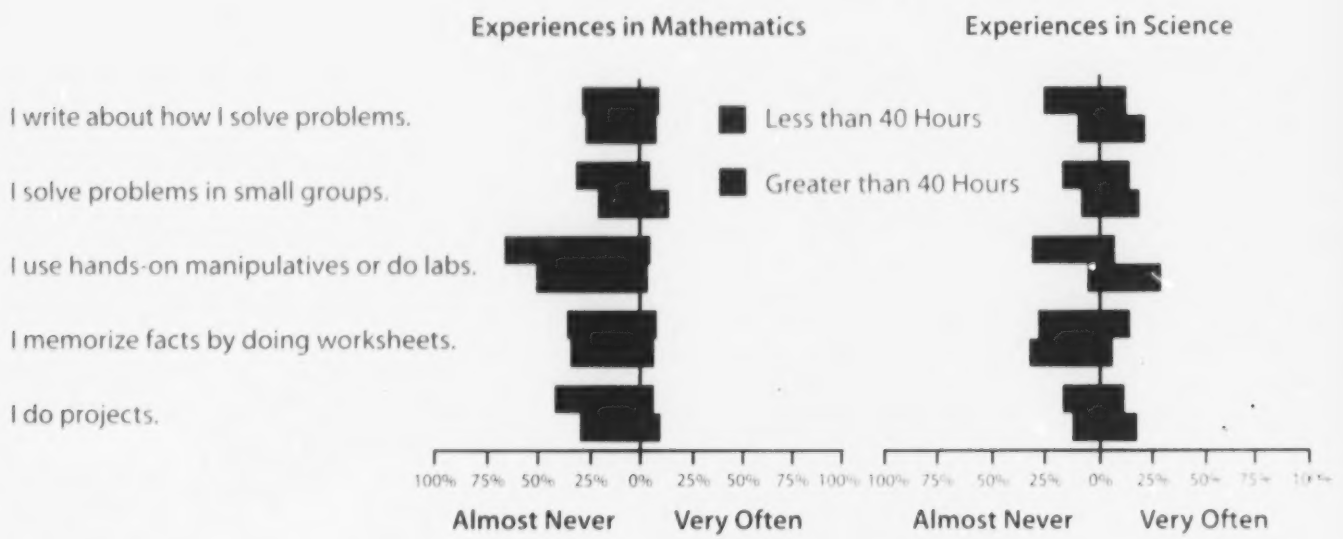
Figure 6: Students and Teachers Responding *"Very Often"* to Effective Classroom Practices in Science and Mathematics


Students use information to support answers.
Students talk with one another about how to solve problems.
Students learn alternative explanations to science problems.
Teachers require students to support claims.
Teachers use open-ended questions.
Less than 40 Hours
Greater than 40 Hours
100% 75% 50% 25% 0% 25% 50% 75% 100%
Students
Teachers

How are Students Learning?

Teaching strategies that improve science and mathematics learning among economically disadvantaged students are used more frequently by teachers with 40 or more hours of professional development.

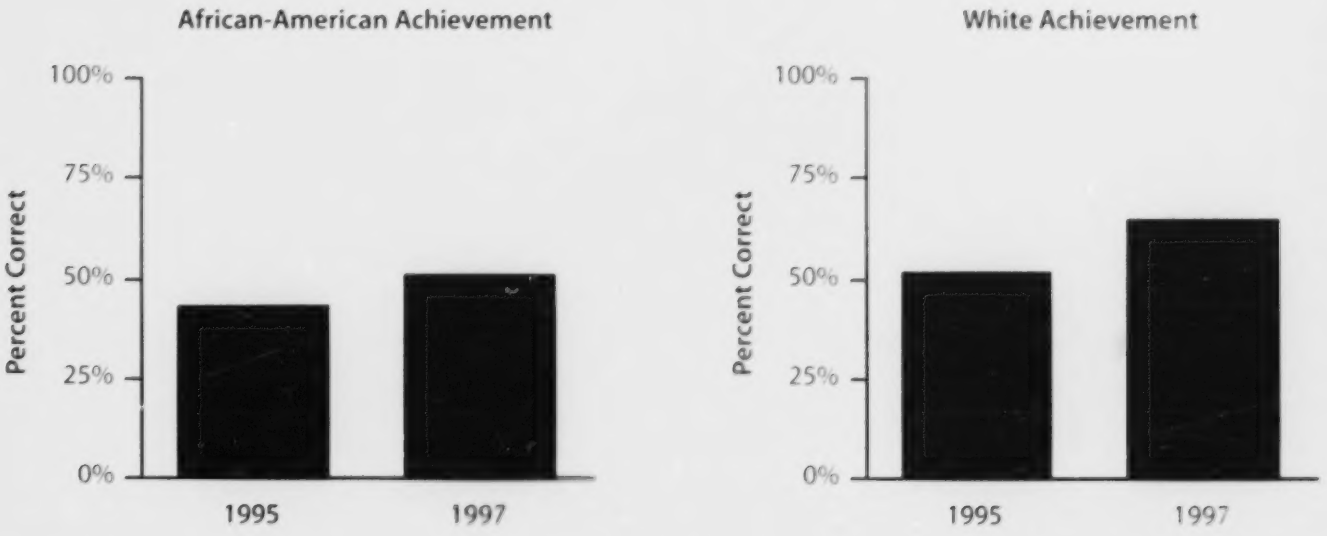
Figure 7: Student Learning Activities


Experiences in Mathematics
Experiences in Science
I write about how I solve problems.
I solve problems in small groups.
I use hands-on manipulatives or do labs.
I memorize facts by doing worksheets.
I do projects.
Less than 40 Hours
Greater than 40 Hours
100% 75% 50% 25% 0% 25% 50% 75% 100%
Almost Never
Very Often

Has Mathematics Learning Increased?

Beginning in 1995 (baseline scores), achievement levels in economically disadvantaged urban and rural schools rose in mathematics.

Figure 8: Student Achievement in Mathematics

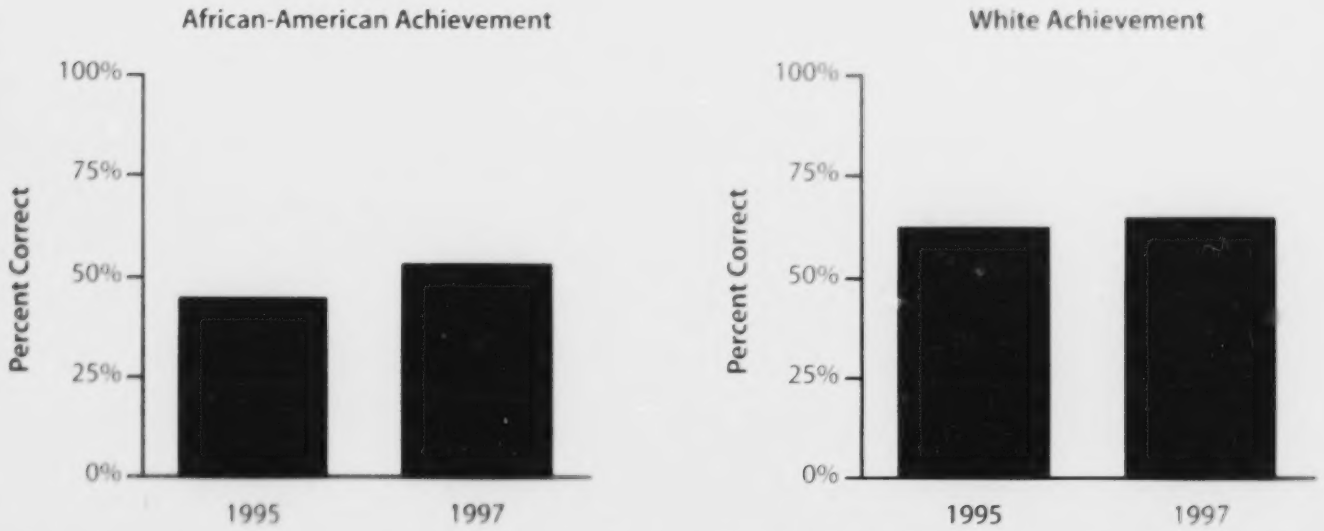


Note: Achievement data is shown only for students in schools that have participated every year.

Has Science Learning Increased?

In economically disadvantaged urban and rural schools, improvement in science achievement is greater for African-American students than for white students.

Figure 9: Student Achievement in Science

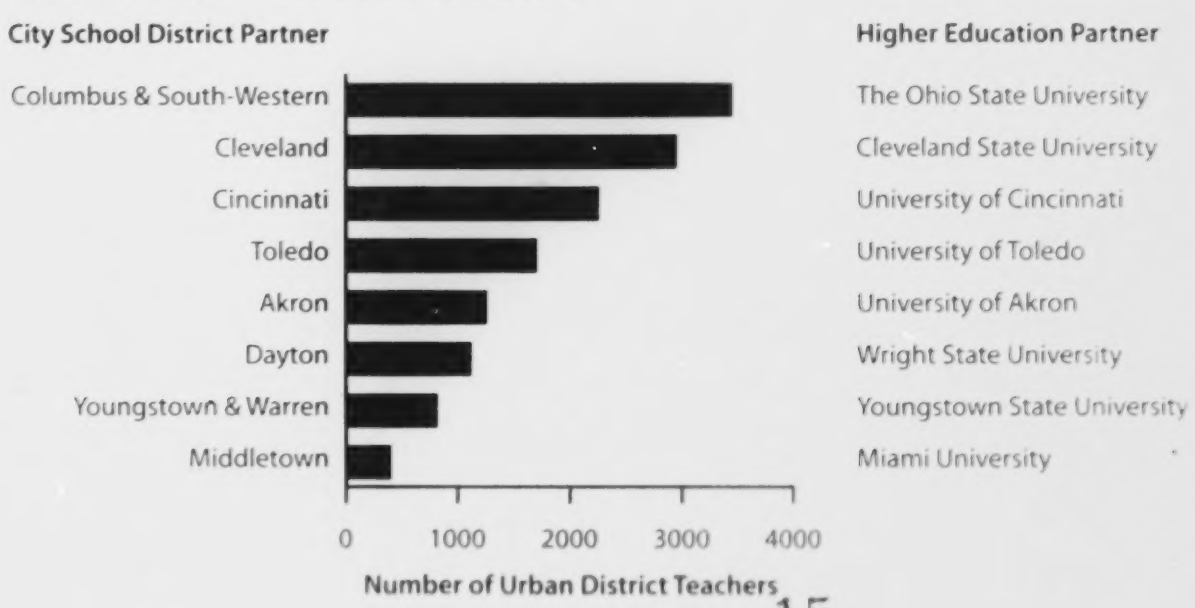


Note: Science and mathematics achievement cannot be compared directly because the difficulty levels of the two tests are not identical.

How Will Ohio's Reform Be Sustained?

Through Project *SUSTAIN*, collaborations have been formed between Ohio's largest school districts and institutions of higher education. The collaborations focus on improving undergraduate education in science and mathematics, particularly for prospective teachers.

Figure 10: Project *SUSTAIN* Collaborations



Who is Guiding Ohio's Reform of Science and Mathematics Education?

Representatives from the following institutions and agencies meet as *OSI-Discovery*'s Coordinating Council to guide and shape the reform:

Cincinnati Federation of Teachers
Cleveland Urban Systemic Initiative
Columbus Urban Systemic Initiative
Miami University
Ohio Board of Regents
Ohio Department of Education
Ohio Education Association
Ohio Mathematics & Science Coalition
Ohio School Board Association
The Ohio State University
Sinclair Community College
State University Education Deans
University of Toledo Community & Technical College
Wright State University

For more information about Ohio's systemic reform of science and mathematics education:

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